ARIZONA TRANSPORTATION RESEARCH CENTER

RESEARCH NOTES:

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Arizona Local Government Safety Project Analysis Model

Highlights

- FHWA requires a detailed analysis to assess and determine the most critical candidate safety projects.
- This research is intended to provide local governments with an efficient and justifiable means of assigning priority to projects for a local safety program.
- The Arizona LGSP model provides an effective and rational means of selecting and prioritizing hazardous local sites, and evaluating safety treatment strategies.

Background

A significant number of local governments in Arizona do not determine candidate projects for safety program funding on and off the federal aid system. Due to the time and expense required for the preliminary data collection and site assessment, some local governments lack the resources for an in-depth analysis of highway safety needs in their jurisdiction. This is particularly significant because high-incident locations statewide may go without mitigation or correction despite the availability of federal aid for these projects.

The FHWA Surface Transportation Program provides a 10% set-aside for highway safety improvements, the majority of which (85.9% in fiscal 1999) are designated for hazard elimination. Of this amount, the Arizona Department of Transportation currently sets aside up to 25% of all safety category funds for "first-come, first-served" local government safety projects. Recipient jurisdictions are allocated 94.3% of project costs in HES funds, with a 5.7% match required of locally sponsored projects. In fiscal 1999, nearly $2.4 million was available for local government safety projects.

The FHWA requires a detailed analysis to assess and determine the most critical candidate safety projects on the public road network. This assessment is made, in part, by using traffic accident records collected by the Traffic Records Department of the Arizona Department of Transportation, with supplementary information provided by local governments. Guidelines for the assessment require using data collected for a period of at

least 3 years, with a 5-year time frame recommended. A benefit-to-cost ratio (BCR) of at least 1.0 is required to establish project eligibility.

The study of highway safety data has been characterized in terms of two categories. The first, analysis, refers to the use of data to address problems and questions from the standpoint of evaluation and research and development. In contrast, implementation is concerned with the use of data to develop warrant criteria and to select projects based on these criteria. The focus of this research has been primarily on development of implementation strategies for local safety projects. While some analysis has been devoted to the multiple variables that affect the outcome of a safety measure, the primary aim of that analysis was the synthesis of data such as traffic volumes, average speed, type and design of roadway, and special circumstances, in order to develop appropriate parameters for implementation strategies.

It should be noted that few analyses or implementation strategies can be completed solely through the use of automation or centralized research. Identification and mitigation of safety hazards in local jurisdictions is subject to the unique characteristics of each local area and each particular countermeasure program, and there is no one who can understand and interpret the results of local-level analyses better than the individuals who are working in the local area on a daily basis. This research provides a tool for simplifying the process, but the key responsibility for translating this information into appropriate countermeasures rests with local officials and traffic engineers.

Approach

This report is divided into three primary sections. The first, Safety Project Evaluation, provides background information on the safety project evaluation process. This includes discussion of the multiple steps in the project selection and implementation process, and a review of existing literature related to the variables involved. These steps include the identification of hazardous locations for which mitigation is warranted, the conversion of crash data to corresponding economic costs, the selection of specific project alternatives from a variety of treatments, and the estimation of net benefits associated with project implementation. When applicable, data have been adjusted to reflect local conditions.

The second section, contains a discussion of the Arizona Local Government Safety Project Model developed to facilitate site identification and safety project selection by local jurisdictions and planning organizations. Included in this section are a discussion of the structure and components of the model, rationale for design decisions and parameters for data collection and sorting, Arizona-specific estimators built into the model, and a summary of the model's capabilities and limitations (i.e. what can and can not be achieved). This section does not contain specific instructions for the end user. A brief instruction manual and update procedures are included in Appendix A of this report.

A sample study for the Central Arizona Association of Governments (CAAG) is provided in the third section of the report. The CAAG case study includes background information on the numerous jurisdictions in the CAAG region, historical summaries of motor vehicle travel and crash data, as well as hazardous sites for several jurisdictions

identified with the Arizona Local Government Safety Project Model. The parameters used to identify these sites, as well as sample project assessments and expected benefits are also included.

The various appendices to this report provide supplementary data that should prove useful for evaluation of traffic safety treatments by users of the Arizona LGSP Model and non-users alike. Appendices A and B provide instructions for using the Arizona LGSP Model. Appendix C is a detailed glossary of safety-related terminology, including roadway, safety, construction and economic terms. Appendix D replicates Arizona-specific estimates of effectiveness for a variety of safety treatments, and Appendix E includes effectiveness estimates for a greater variety of projects assembled from previous research.

Findings

This research is intended to address the challenges faced by local governments in identifying treatment sites for safety program funding. Traffic safety programming is a multiple-step process, in which data must be collected and analyzed to determine where problems are occurring, what types of problems are occurring, and what treatments might have the potential to remedy these problems. Once potential treatments have been identified, additional decisions must be made regarding available funds and the relative benefit to be obtained from each potential safety improvement. Because this is a time-consuming process, many local governments in Arizona do not regularly determine candidate projects for safety program funding, even though federal aid may be available for these projects.

This report addresses these concerns in a number of ways. First, background information has been collected and summarized for many of the facets involved in the identification of hazardous locations, the selection of treatment strategies, and the evaluation of potential projects. Using this information as a base from which to start, an automated model was then designed to facilitate the site selection and project evaluation portions of the local safety programming process. The Arizona Local Government Safety Project Implementation Model was designed as a tool for aiding local governments in this process by automating the following procedures:

- Identification of hazardous locations in a jurisdiction;
- Prioritization of those sites by user-defined parameters;
- Aggregation of details for crashes at each site, including estimated economic costs of crashes observed;
- Statistical summaries of crash rates and variance for each site, with the option to evaluate data adjusted for user-input traffic volumes;
- Identification of comparable locations in a jurisdiction for before-after treatment comparisons;
- Input and formatting of potential safety projects for further analysis;
- Evaluation of safety project alternatives to determine benefit-cost ratios
- Reporting of data in user-friendly formats, following project submittal guidelines

The Arizona LGSP model provides an effective and rational means of selecting and prioritizing hazardous local sites, and evaluating safety treatment strategies. The model's project evaluation routine allows multiple projects to be analyzed at once, with minimal run time,

providing opportunities to revise site selection and project characteristics throughout the programming process. It is important to note that the Arizona LGSP model is intended as a *tool*, not as a replacement for the expertise of a traffic engineer. By automating the collection and preliminary analysis of crash records, the LGSP model affords local traffic engineers more time to evaluate hazardous locations and select appropriate safety improvements.

Several improvements could be made to the Arizona LGSP model as the required data become available. Note that most of these options were considered for the preliminary design, but were rejected due to constraints in available data or policy requirements. The following revisions could improve the functioning or utility of future versions of the LGSP model:

- Coordination of traffic data with crash locations as Arizona HPMS coverage increases;
- Inclusion of geographical coding or spatial reference data to identify sites visually and to augment the fixed-point method of site identification;
- Change from costs per crash to costs per injury to allow for the variance in vehicle and occupant involvement by location;
- Conversion of crash data to smaller CD files (county level) to speed model updates

Implementation of the first two items would allow the model to provide additional data that many jurisdictions might find useful. However, at the time of development, these data sets remained incomplete. Estimated costs per injury were removed from the first version of the Arizona LGSP to comply with reporting requirements for HES program funding eligibility. The last item may be easily accomplished by local governments as crash data files are updated. Using smaller data files would reduce the amount of time required for Arizona LGSP updates, making adjustments easier to perform.

Use of the Arizona LGSP model is voluntary, and is not required of any jurisdictions applying for safety program funding in Arizona. However, users of the LGSP model should find that it significantly reduces the amount of time required for preliminary data collection and analysis. In addition, the model contains reference values for project assessment variables such as economic costs of crashes according to severity, capital recovery factors for annualizing safety project expenditures, project life cycles by type, and estimated reduction in crashes that may be obtained for a variety of safety improvements. Finally, the model generates a variety of location, crash and project reports that should prove useful for safety program funding applications.

It should be noted that few analyses or implementation strategies can be completed solely through the use of automation or centralized research. This research provides a useful tool for simplifying the process, but the key responsibility for translating this information into appropriate countermeasures rests with local officials and traffic engineers.

The full report *Arizona Local Government Safety Project Analysis Model* by Jason Carey (Arizona Department of Transportation, report number FHWA-AZ-01-504, published June 2001) is available from the Arizona Transportation Research Center, 206 S. 17 Ave., mail drop 075R, Phoenix, AZ 85007; phone 602-712-3138.